

# Unmanned Aerial Vehicle (UAV) Capabilities

MTRI utilizes remote controlled helicopters to collect remote sensing data. With current advances in these technologies, they have become cheaper and more capable systems. In combination with similar advances in sensors, unmanned aerial vehicles (UAVs) are a more practical and cost effective way to collect remote sensing data.

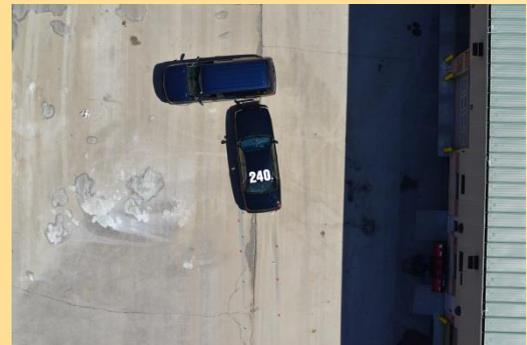
UAVs can be equipped with a variety of sensors, including optical (visible and near-infrared light), thermal, and LiDAR. They also come in several main platforms, including single-rotor helicopters, multi-rotor helicopters, tethered devices (such as balloons and blimps), and fixed-wing aircraft. MTRI has focused on using helicopter based platforms due to their stability and the ability to takeoff and land vertically. This allows for the operation not only from land but also from small boats for aquatic studies.

UAVs can be used for a variety of research. This includes transportation, ecology and other disciplines. The advantage of using UAVs is that they are a low cost alternative to collecting aerial remote sensing where and when its needed. Unlike optical satellite collects, UAVs are not restricted to cloud cover or having to wait for an overpass. Alternatively, weather conditions such as wind can impact the ability to operate.

With multiple platforms available MTRI is able to investigate a wide variety of sites ranging from confined space inspection to a wide variety of terrestrial and aquatic collects. Currently, projects have been funded through USDOT and MDOT to test the capabilities and uses of UAVs in transportation.



**Pump Station Inspection**



**Accident Reconstruction**



**Harsens Island, MI Wetland Analysis**



**Unpaved Road Assessment**



**Drummond Island, MI Reef Detection**

The **Bergen Hexacopter** can fly for up to 30 minutes with a 5 kg payload. It has a global position system (GPS) inertial measurement unit (IMU) which allows for flying programmed way points that are assigned through Ground Station software that uses a Google Earth interface. With a stabilized gimbal that keeps the camera pointed down regardless of the motion of the hexacopter, this provides a more stable platform than the single rotor helicopter. The added first person viewer (FPV) allows the pilot to see the field of view of the camera as well as provide a read out of the altitude, speed and battery voltage. *Manufactured in Michigan*



**Bergen Hexacopter**

The **Lehmann Aviation LP960** can fly for up to 25 minutes with a high-resolution camera payload, with automated flight capabilities and FPV cameras to assist the operator. It is particularly useful for mapping corridors and rapidly gathering data over larger areas.



**Lehmann Aviation LP960**

The **Bergen Tazer 800** is an electric powered helicopter with a full autopilot system. It is also equipped with a GPS IMU that allows for waypoint flights. Through this software, the user can adjust altitude, speed and coordinates based on GPS measurements. It has the capability of carrying up to 10 kg of payload for 18 minutes. The large payload capacity allows for a wide range of equipment to be carried. *Manufactured in Michigan*



**Bergen Tazer 800**

The **DJI Phantom**, **Phantom Vision 2** and **3D Robotics IRIS** are smaller quadcopters that can perform a variety of tasks. The Phantom is equipped with a GoPro camera that can capture 12 MP imagery while the Phantom Vision 2 comes equipped with a 13 MP camera that also doubles as an FPV. With cameras equipped, the Phantom can fly for up to 5 min, the IRIS for 12 min and the Phantom Vision 2 can fly for 25 min. They are also equipped with a GPS IMU that allows for them to hold their position while in flight. The vehicles unloaded weight is approximately 1 kilogram and are small enough to be easily transported. A waterproof quadcopter is being added in 2014.



**DJI Phantom Vision 2**

**Micro UAVs** are the smallest quadcopters in MTRI's fleet. Currently MTRI is using a variety of models for testing in confined spaces, such as culverts and pump stations. Their capabilities range from being able to record HD video, transmit a live video stream and also demonstrate obstacle avoidance. One example, the Crazyflie, has an unloaded weight of 19 grams and its flight parameters are completely programmable with an open source user community. MTRI's Blackout Mini H Quad is capable of indoor and outdoor flight with a camera and FPV system.



**3D Robotics IRIS**



**Blackout Mini H Quad**

## Michigan Tech Research Institute

3600 Green Ct., Ste. 100 • Ann Arbor, MI 48105 • USA • 734.913.6840 (p) • 734.913.6880 (f) • [www.mtri.org](http://www.mtri.org)

Colin Brooks  
Lab Manager  
(734) 913-6858  
[cnbrooks@mtu.edu](mailto:cnbrooks@mtu.edu)

Richard Dobson  
Research Associate  
(734) 913-6872  
[rjdobson@mtu.edu](mailto:rjdobson@mtu.edu)